

001P0001

I claim:

1. A medical infusion pump comprising:

a fluid storage chamber for storing fluid medication;

a pump outlet;

5 a pump flowpath positioned between said fluid storage chamber and said pump outlet providing fluid communication between said fluid storage chamber and said pump outlet, wherein said pump flowpath includes a flow restriction, a drip chamber, and a sight window, said flow restriction exiting into said drip chamber and said sight window oriented to enable visual contact with said drip chamber, and wherein said flow restriction is sized to convert a continuous stream of fluid entering said flow restriction from said fluid storage chamber to a drip stream exiting said flow restriction into said drip chamber;

10 a displacement piston displaceably positioned in said fluid storage chamber; and

15 an elastic member engaging said displacement piston and transitionable between a more stressed position and a less stressed position to displace said displacement piston.

20 2. The pump of claim 1 further comprising an outlet tube positioned beneath said flow restriction in said drip chamber separated from said flow restriction by a drip gap, wherein said outlet tube is configured to convert said drip stream exiting said flow restriction to a reverted continuous stream.

3. The pump of claim 1, wherein said elastic member is a spring.

4. A medication delivery system comprising:

a) an infusion pump including,

25 a fluid storage chamber for storing fluid medication,

a pump outlet,

a pump flowpath providing fluid communication between said fluid storage chamber and said pump outlet,

a displacement piston displaceably positioned in said fluid storage

chamber, and

a spring engaging said displacement piston and transitionable between a more stressed position and a less stressed position to displace said displacement piston; and

5 b) a bolus injector positioned in series with said infusion pump including,  
a flexible bladder,  
a bolus chamber enclosed by said flexible bladder,  
an injector inlet into said bolus chamber and connected to said pump outlet,

10 an injector outlet out of said bolus chamber, and  
an outlet valve positioned at said injector outlet and transitionable between an open position and a closed position, wherein said outlet valve is biased to said closed position and transitioned to said open position in response to ambient pressure of fluid medication contacting said outlet valve.

15 5. The system of claim 4, wherein said bladder has an elastic memory to restore said bladder to an initial configuration after said bladder is deformed by compression.

20 6. A medication delivery system comprising:

25 a) a infusion pump including,  
a fluid storage chamber for storing medication fluid,  
a pump outlet,  
a pump flowpath providing fluid communication between said fluid storage chamber and said pump outlet, wherein said pump flowpath has a flow restriction and a drip chamber, and wherein said flow restriction is sized to convert a continuous stream of fluid entering said flow restriction from said fluid storage chamber to a drip stream exiting said flow restriction into said drip chamber,  
a displacement piston displacably positioned in said fluid storage

chamber, and

an elastic member engaging said displacement piston and transitionable between a more stressed position and a less stressed position; and

5 b) a bolus injector positioned in series with said infusion pump including,  
a flexible bladder,  
a bolus chamber enclosed by said flexible bladder,  
an injector inlet into said bolus chamber and connected to said pump outlet, and

10 an injector outlet out of said bolus chamber.

7. The system of claim 6, wherein said pump flowpath includes a sight window oriented to enable visual contact with said drip chamber.

15 8. The system of claim 6 further comprising an outlet tube positioned beneath said flow restriction in said drip chamber separated from said flow restriction by a drip gap, wherein said outlet tube is configured to revert said drip stream exiting said flow restriction to a reverted continuous stream.

9. The system of claim 6, wherein said bolus chamber has a fluid capacity substantially less than said fluid storage chamber.

20 10. The system of claim 6 further comprising an outlet valve positioned at said injector outlet and transitionable between an open position and a closed position, wherein said outlet valve is biased to said closed position and transitioned to said open position in response to ambient pressure of fluid medication contacting said outlet valve.

25 11. A medication delivery system comprising:

a) a first infusion pump including,  
a first fluid storage chamber,  
a first pump outlet,  
a first pump flowpath providing fluid communication between said first fluid storage chamber and said first pump outlet,

a first displacement piston displaceably positioned in said first fluid storage chamber, and

a first elastic member engaging said first displacement piston and transitionable between a more stressed position and a less stressed position to displace said first displacement piston;

b) a second infusion pump including,

a second fluid storage chamber,

a second pump outlet,

a second pump flowpath providing fluid communication between said second fluid storage chamber and said second pump outlet,

a second displacement piston displaceably positioned in said second fluid storage chamber, and

a second elastic member engaging said second displacement piston and transitionable between a more stressed position and a less stressed position to displace said second displacement piston;

c) a bolus injector positioned in series with said second infusion pump including,

a flexible bladder,

a bolus chamber enclosed by said flexible bladder,

an injector inlet into said bolus chamber and connected to said second pump outlet, and

an injector outlet out of said bolus chamber;

d) a junction connecting said first pump outlet with said injector outlet; and

e) a common flow tube exiting said junction and in fluid communication with said first pump outlet and said injector outlet.

12. The system of claim 11, wherein said first pump flowpath has a flow restriction and a drip chamber, wherein said flow restriction is sized to convert a continuous stream of fluid entering said flow restriction from said fluid storage chamber to a drip stream exiting said flow restriction into said drip chamber.

001P0001

13. The system of claim 11, wherein said first pump flowpath includes a sight window oriented to enable visual contact with said drip chamber.

14. The system of claim 11 further comprising an outlet tube positioned beneath said flow restriction in said drip chamber separated from said flow restriction by a drip gap, wherein said outlet tube is configured to revert said drip stream exiting said flow restriction to a reverted continuous stream.

15. The system of claim 11, wherein said first elastic member is a spring.

16. The system of claim 11, wherein said second elastic member is a spring.

17. A medication delivery system comprising:

a) an infusion pump including,

a fluid storage chamber,

a first pump outlet and a second pump outlet,

a pump flowpath providing fluid communication between said fluid storage chamber and said first pump outlet,

a displacement piston displaceably positioned in said fluid storage chamber, and

an elastic member engaging said displacement piston and transitionable between a more stressed position and a less stressed position to displace said displacement piston;

b) a bolus injector including,

a flexible bladder,

a bolus chamber enclosed by said flexible bladder,

an injector inlet into said bolus chamber and connected to said second pump outlet, and

an injector outlet out of said bolus chamber.

c) a junction connecting said first pump outlet with said injector outlet; and

d) a common flow tube exiting said junction and in fluid communication with said first pump outlet and said injector outlet.

18. The system of claim 17 wherein said pump flowpath has a flow restriction

001P0001

and a drip chamber, and wherein said flow restriction is sized to convert a continuous stream of fluid entering said flow restriction from said fluid storage chamber to a drip stream exiting said flow restriction into said drip chamber.

5 19. A method for delivering a fluid medication to a treatment site of a patient comprising:

charging a bolus injector with a fluid medication, wherein said bolus injector is a flexible bladder enclosing a bolus chamber and having an injector inlet into said bolus chamber and an injector outlet out of said bolus chamber;

10 charging a fluid storage chamber serially positioned upstream of said bolus injector with said fluid medication, wherein said fluid storage chamber is in fluid communication with a pump outlet via a pump flowpath and further wherein said pump outlet is in fluid communication with said injector inlet;

15 applying a displacement force to said fluid medication in said fluid storage chamber from an elastic member transitioning from a more stressed position to a less stressed position to serially displace said fluid medication from said fluid storage chamber and said pump flowpath into said bolus chamber;

opening an outlet valve biased closed and positioned at said injector outlet in response to ambient pressure of said fluid medication contacting said outlet valve; and

discharging said fluid medication from said injector outlet.

20 20. The method of claim 19 further comprising connecting an inlet end of a catheter with said injector outlet, positioning an outlet end of said catheter in a treatment site of a patient, and displacing said fluid medication through said catheter to deliver said fluid medication to said treatment site.

25 21. The method of claim 19, wherein said fluid medication is displaced from said fluid storage chamber as a continuous stream, said method further comprising driving said continuous stream of said fluid medication into a flow restriction in said pump flowpath, wherein said fluid medication exits said flow restriction as a drip stream.

22. A method for selectively delivering a fluid medication to a treatment site of a patient comprising:

charging a bolus injector with a fluid medication, wherein said bolus injector is a flexible bladder enclosing a bolus chamber and having an injector inlet into said bolus chamber and an injector outlet out of said bolus chamber;

5 charging a fluid storage chamber serially positioned upstream of said bolus injector with said fluid medication, wherein said fluid storage chamber is in fluid communication with a pump outlet via a pump flowpath and further wherein said pump outlet is in fluid communication with said injector inlet; and

10 selecting between an extended mode and an instantaneous mode of delivering said fluid medication to a treatment site, wherein said extended mode is performed by applying a first displacement force to said fluid medication in said fluid storage chamber from a spring transitioning from a more stressed position to a less stressed position to serially displace said fluid medication from said fluid storage chamber through said pump flowpath, said bolus chamber, and said injector outlet into said treatment site at a first flow rate over a long time, and wherein said instantaneous mode is performed by applying a second displacement force to said bolus injector sufficient to displace said fluid medication from said bolus chamber through said injector outlet into said treatment site at a higher second flow rate over a short time.

20 23. The method of claim 22 , wherein said fluid medication is displaced from said fluid storage chamber as a continuous stream, said method further comprising driving said continuous stream of said fluid medication into a flow restriction in said pump flowpath, wherein said fluid medication exits said flow restriction as a drip stream.

25 24. The method of claim 22, wherein said fluid medication is displaced through said injector outlet by opening an outlet valve biased closed and positioned at said injector outlet in response to ambient pressure of said fluid medication contacting said outlet valve.